

What is claimed is:

1. A method of preparing a water dispersion of a urethane polymer which comprises

- (a) preparing at least two different isocyanate-terminated polyurethane prepolymers;
- (b) mixing said prepolymers to form a mixture; and
- (c) dispersing said mixture of prepolymers in an aqueous medium.

2. A method of claim 1 wherein in the preparation of each prepolymer at least one different reactant is employed, where the reactants are selected from the group consisting of aromatic isocyanates, aliphatic isocyanates, araliphatic isocyanates, polyether polyols, polyester polyols, polycarbonate polyols, polyacetal polyols, polycaprolactone polyols, alkylene glycols, polyacrylates polyols, silicone polyols, halogenated polyols, chain extenders, water dispersability enhancing compounds, and polyols of different molecular weights.

3. A method of preparing an aqueous dispersion of non-uniform polyurethane particles which comprises

- (a) preparing at least two isocyanate-terminated polyurethane prepolymers having different hydrophilicities;
- (b) mixing said prepolymers to form a mixture; and
- (c) dispersing said mixture of prepolymers in an aqueous medium to form non-uniform particles.

4. A method of claim 3 wherein different hydrophilicities are achieved by incorporating different levels of acid, as measured by weight percent, equivalents or acid number, in neutralized or unneutralized form.

5. A method of claim 3 wherein said prepolymers are optionally neutralized or chain extended or both neutralized and chain extended before, during or after the dispersion step.

6. A method of claim 3 wherein said prepolymers are prepared separately.

7. A method of claim 3 wherein one prepolymer, that is relatively less hydrophilic, has an acid number from 0 to 10, and the other prepolymer, that is relatively more hydrophilic, has an acid number from 20 to 80.

8. A method of claim 7 wherein said less hydrophilic prepolymer has an acid number from 0 to 5 and said relatively more hydrophilic prepolymer has an acid number from 35 to 60.

9. A method of claim 7 wherein said less hydrophilic prepolymer has an acid number below 1 and said relatively more hydrophilic prepolymer has an acid number from 25 to 80.

10. A method of claim 3 wherein said prepolymers have the isocyanate (NCO) to active hydrogen equivalent ratio of about 1.3:1 to about 2.5:1.

11. A method of claim 10 wherein said equivalent ratio is about 1.5:1 to about 2.1:1.

12. A method of claim 10 wherein said equivalent ratio is about 1.7:1 to about 2:1.

13. A method of claim 3 wherein said prepolymers are neutralized prior to mixing or after mixing the prepolymers but before forming a water dispersion.

14. A method of claim 3 wherein said prepolymers are prepared in the same reactor by preparing the first prepolymer, protecting (blocking) the unreacted isocyanate groups in the first prepolymer by reacting it with a blocking agent, preparing the second prepolymer and, optionally, protecting the unreacted isocyanate groups of the second prepolymer and optionally repeating the preparation and protecting steps of subsequent prepolymers and optionally deblocking said protected groups after all prepolymers have been prepared.

15. A method of claim 3 wherein at least one water-dispersibility enhancing compound is employed with one prepolymer or all prepolymers.

16. A method of claim 15 wherein said water-dispersibility enhancing compound is at least one non-ionic compound.

17. A method of claim 15 wherein said water-dispersibility compound is dimethylol propionic acid and/or dimethylol butanoic acid.

18. A method of claim 15 wherein either prepolymer or both prepolymers contain a water-dispersibility compound that contains both non-ionic and anionic groups.

19. A method of claim 3 wherein a water-dispersibility enhancing compound is incorporated with all prepolymers.

20. A method of claim 7 wherein a water-dispersibility enhancing compound is incorporated with said relatively more hydrophilic prepolymer.

21. A method of claim 3 wherein said polyurethane is crosslinked.

22. A method of claim 3 wherein a surfactant is employed.

23. A method of claim 22 wherein a surfactant is employed during the dispersing stage.

24. A method of claim 3 wherein at least one catalyst is employed.

25. A method of claim 3 wherein at least one reactive diluent is employed.

26. A method of claim 25 wherein the reactive diluent is a polymerizable monomer.

27. A method of claim 3 wherein at least one solvent is employed.

28. A method of claim 3 wherein at least one branching monomer is employed.

29. A method of claim 3 wherein at least one plasticizer is employed.

30. A method of claim 3 wherein said prepolymers contain carboxyl groups which are neutralized.

31. A method of claim 3 wherein chain extension is carried out.

32. A method of claim 3 wherein said non-uniform particles have primarily core-shell morphology.

33. A method of claim 3 wherein said non-uniform particles have primarily gradient morphology.

34. A method of claim 3 wherein said non-uniform particles have primarily "ice-cream cone" morphology.

35. A method of claim 1 wherein said non-uniform particles have primarily "raspberry" morphology.

36. A method of claim 1 wherein said non-uniform particles have primarily "salt-and-pepper" morphology.

37. A method of claim 1 wherein said non-uniform particles have two or more different morphologies.

38. An aqueous dispersion of polyurethane particles having primarily non-uniform morphology.

39. An aqueous dispersion of claim 38 wherein said non-uniform morphology is primarily core-shell.

40. An aqueous dispersion of claim 38 wherein said non-uniform morphology is primarily of gradient morphology.

41. An aqueous dispersion of claim 38 wherein said non-uniform morphology is primarily of "raspberry" morphology.

42. An aqueous dispersion of claim 38 wherein said non-uniform morphology is primarily of "salt-and-pepper" morphology.

43. An aqueous dispersion of claim 38 wherein said non-uniform morphology is composed of two or more different morphologies.

44. An aqueous dispersion of claim 38 wherein said non-uniform particles are a mixture of core-shell and gradient morphology.

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45. An aqueous dispersion of urethane particles having primarily non-uniform particles prepared by a method which comprises

- (a) preparing at least two isocyanate-terminated polyurethane prepolymers having different hydrophilicities;
- (b) mixing said prepolymers to form a mixture; and
- (c) dispersing said mixture of prepolymers in an aqueous medium.

46. A composition of matter comprising a mixture of at least two different isocyanate-terminated polyurethane prepolymers.

47. A composition of claim 46 wherein said different prepolymers have different hydrophilicities.

48. A composition of claim 46 wherein at least one of said prepolymers is blocked.

49. A composition of matter of claim 46 wherein said prepolymers differ in acid numbers by at least 10 units.

50. An aqueous dispersion of the composition of claim 46.

51. An aqueous dispersion of the composition of claim 48.

52. A polyurethane composition in dry form obtained from an aqueous dispersion of claim 38.

53. A polyurethane composition in dry form obtained from an aqueous dispersion of claim 39.

54. A polyurethane composition in dry form obtained from an aqueous dispersion of claim 43.

55. A method of preparing a composition of claim 46, said method comprising

(a) preparing at least two different isocyanate-terminated polyurethane prepolymers, and

(b) mixing said prepolymer to form a mixture of the prepolymers.

56. A dispersion comprising a dispersion of claim 45 and at least one dispersion of a different polymer.

57. A dispersion of claim 56 wherein said different polymer is selected from acrylic, vinyl and polyurethane polymers.

58. An article of manufacture prepared from a dispersion of claim 45.

59. An article of claim 58 wherein said articles is selected from film, coating and adhesive.